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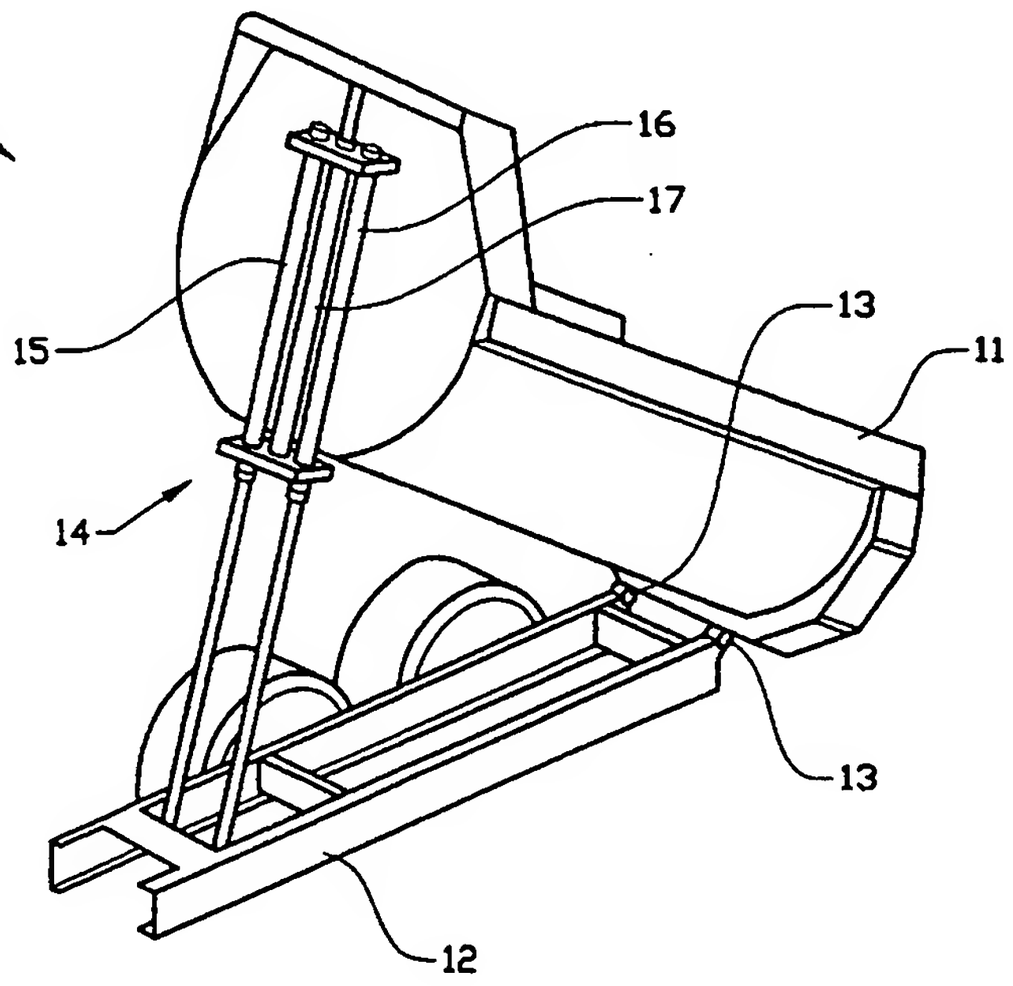
(54) Title: HYDRAULIC TIPPING ARRANGEMENT FOR A TRUCK




(57) Abstract: The invention relates to a hydraulic arrangement for operating a load body (11) on a heavy vehicle. The load body is connected to the frame (12) of the vehicle by way of at least one articulated joint (13), enabling it to tip, and is designed to be moved between a lowered transport position and a raised tipping position. A hydraulic cylinder assembly (14) forming part of the hydraulic arrangement comprises at least two piston cylinders (15-17), each working in its own direction, which are hydraulically and mechanically coupled to one another.

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# Hydraulic tipping arrangement for a truck

## TECHNICAL FIELD

The present invention relates to a hydraulic arrangement for operating a load body on a heavy vehicle, the load body being connected to the frame of the vehicle by way of at least one articulated joint, enabling it to tip, and being designed to be moved between a lowered transport position and a raised tipping position.

## BACKGROUND ART

A heavy vehicle or dumper truck carrying gravel in a load body, for example, discharges its load by tipping the said body. The load body, which is supported at the rear end of the vehicle, can be tipped to a maximum of 60° to 70°. Tipping is performed either by a directly acting lifting cylinder or indirectly via a knuckle joint arrangement (a system of linkages coupled to load body and vehicle frame, which is in turn actuated by lifting cylinders).

There are many requirements to be taken into account when designing a tipping system. The system should, for example, be efficient, that is to say it should rapidly tip the load and rapidly return to the home position. It is advantageous here to be able to use "small" hydraulic cylinders having a short stroke and moderate hydraulic pressure, since this means that the hydraulic system can be of simpler design and does not need to function with such large flows of hydraulic fluid.

Some of the requirements conflict with one another. A short stroke, for example, means large forces and big cylinders. Here the tipping geometry has great significance for the interplay of forces.

If a point of action used for a tipping cylinder between the vehicle frame and the load body is applied essentially at the greatest distance from the load body bearing points on the frame, the force required of the piston cylinder is relatively low, but the piston cylinder then needs to be long. Use is therefore often made of telescopic cylinders, which extend in a number of stages. This again becomes a slow process, since its large diameter is also offset by large oil flows per unit time. A telescopic cylinder is moreover mechanically sensitive, since it has large sealing surfaces with increased risk of leakage.

Another example of cylinder mounting is to place single cylinders on either side of the load body, that is to say with points of action shifted towards the load body bearing point on the vehicle frame. Since this shortens the lever arm, the power required from the tipping cylinders is increased.

US 4488756 describes a tipping system having a master cylinder and two secondary cylinders, which act in different directions. The master cylinder is fitted at the front edge of the load body and the two secondary cylinders are fitted with their point of action between the two ends of the load body. The master cylinder is intended to act during a first phase of the tipping, during which the power

requirement is greatest. This known solution means that the hydraulic system becomes relatively complex.

DISCLOSURE OF INVENTION

An object of the invention therefore is to provide a cost-effective and reliable hydraulic arrangement, which is capable of rapidly performing an up and down tipping movement.

To achieve this object, the hydraulic arrangement according to the invention is characterized by a hydraulic cylinder assembly, which comprises at least two piston cylinders, each working in its own direction, which are hydraulically and mechanically coupled to one another. By means of this design of the arrangement it is possible to optimize the pressure area in two or more stages during a tipping cycle, so that the hydraulic system can be made simple and hydraulically efficient, which reduces the cycle time for a tipping movement.

According to an advantageous variant of the invention, piston cylinders of the hydraulic cylinder assembly are arranged parallel and working in opposite directions. This design gives a compact, mechanically solid unit.

According to yet another advantageous variant of the invention, the hydraulic cylinder assembly comprises three piston cylinders, of which two work in the same direction and the third piston cylinder is located in the same plane between the said two piston cylinders. This provides a unit that can easily be assembled and disassembled.

The pistons of both of the outer piston cylinders are suitably connected directly to the vehicle frame, and the piston of the middle piston cylinder is suitably connected to the load body.

Further advantageous exemplary embodiments of the invention are set forth in the following claims.

BRIEF DESCRIPTION OF DRAWINGS

The invention will be described in more detail below with reference to exemplary embodiments as shown in the drawings attached, of which

FIG 1 is a perspective view showing the rear part of a heavy vehicle having a hydraulic arrangement according to the invention,

FIG 2-4 show the hydraulic arrangement according to the invention in three different working positions,

FIG 5 shows a basic schematic diagram of the operation of the hydraulic arrangement according to the invention.

MODES FOR CARRYING OUT THE INVENTION

The heavy vehicle 10 shown in Figure 1 is provided with a load body 11, which in a known manner is connected to the frame 12 of the vehicle by articulated joints 13, enabling it to tip. Figure 1 shows the load body 11 in a position between lowered transport position and fully raised tipping position. Operation between these positions is performed

by means of a hydraulic arrangement comprising a hydraulic cylinder assembly 14, arranged at the front end of the load body, and a hydraulic system.

In the exemplary embodiment shown the hydraulic cylinder assembly 14 comprises two outer parallel primary piston cylinders 15, 16 and a secondary piston cylinder 17 located between these cylinders and in the same plane. All piston cylinders are hydraulically and mechanically coupled to one another, the piston cylinders 15, 16 working in the same direction and the piston cylinder 17 working in the opposite direction. It is naturally possible to use more or fewer piston cylinders in the hydraulic cylinder assembly.

Figures 2 to 4 show the hydraulic cylinder assembly 14 in three different operative positions, Figure 2 showing the primary piston cylinders 15, 16 and the secondary piston cylinder 17 in a retracted position. Figure 3 shows the primary piston cylinders in the extended position corresponding to Figure 1. Figure 4 shows both primary piston cylinders 15, 16 and secondary piston cylinder 17 in the extended position.

Figure 5 shows a diagram of a hydraulic system for the operation of the hydraulic cylinder assembly 14. The system is simplified in that it only shows the one primary piston cylinder 15, which is provided with a piston rod 15a having a first internal passage 18 into the compression chamber 19 of the piston cylinder, and a second internal passage 20 into the expansion chamber 21 of the piston cylinder. The secondary piston cylinder 17 is coupled in

parallel with the primary piston cylinder 15, in such a way that the compression chamber 19 of the primary piston cylinder 15 is connected by way of a fluid line 22 to the compression chamber 23 of the secondary piston cylinder, and the expansion chamber 21 of the primary piston cylinder 15 is connected by way of a fluid line 24 to the expansion chamber 25 of the secondary piston cylinder.

A hydraulic pump 26 is designed to draw hydraulic fluid from a tank 27 and to deliver the pressurized fluid to a valve unit 28. On expansion of the piston cylinders, a two-way valve 28a forming part of the valve unit 28 according to Figure 5 stops, the piston cylinders thereby being simultaneously pressurized on the expansion side and the compression side by way of the branch lines 29, 30. Since the piston area is greater on the expansion side than on the compression side, the piston rods will be pushed out. On compression of the piston cylinders, the two-way valve 28a of the valve unit 28 is switched over, so that the branch line 30 is connected to the tank 27, so that the pressure on the expansion side of the pistons becomes zero. The excess pressure is maintained on the compression side of the pistons, which means that the piston rods are drawn in. In this way a tipping operation can be performed rapidly and efficiently.

If the hydraulic cylinder assembly comprises two primary cylinders and one secondary cylinder, the area of the secondary cylinder can be adjusted so as to limit the maximum hydraulic pressure required for the tipping movement. For example, the two primary piston cylinders may function within a tipping angle range from 0° to

approximately 30°. The force (expressed as a % of the load) will then have fallen from approximately 47% to approximately 33% of the weight of the load body (which means that the requisite oil pressure has been reduced from 100% to 70%).

The secondary piston cylinder 17 may be connected to the load body by way of a u-link, either with or without a piston cylinder enabling the u-link to be swung away from the load body, as is described, for example, in SE 307898.

The invention must not be regarded as being confined to the exemplary embodiments described above, a number of further variants and modifications being feasible without departing from the scope of the following claims. For example, the heavy vehicle may consist of a trailer that can be connected to a traction vehicle.

CLAIMS

1. A hydraulic arrangement for operating a load body (11) on a heavy vehicle, the load body being connected to the frame (12) of the vehicle by way of at least one articulated joint (13), enabling it to tip, and being designed to be moved between a lowered transport position and a raised tipping position, **characterized by** a hydraulic cylinder assembly (14), which comprises at least two piston cylinders (15-17), each working in its own direction, which are hydraulically and mechanically coupled to one another.

2. The hydraulic arrangement as claimed in claim 1, **characterized in that** the piston cylinders (15-17) of the hydraulic cylinder assembly (14) are arranged parallel and working in opposite directions.

3. The hydraulic arrangement as claimed in claim 1 or 2, **characterized in that** the hydraulic cylinder assembly (14) comprises three piston cylinders, of which two primary piston cylinders (15, 16) work in the same direction and a secondary piston cylinder (17) is located in the same plane between the said two piston cylinders (15, 16).

4. The hydraulic arrangement as claimed in claim 3, **characterized in that** the piston rods of the two primary piston cylinders (15, 16) are connected directly to the vehicle frame (12), and that the piston rod of the secondary piston cylinder (17) is connected to the load body (11).

5. The hydraulic arrangement as claimed in claim 4, **characterized in that** the piston rod of the secondary piston cylinder (17) is connected to the load body (11) by way of a u-link.

6. The hydraulic arrangement as claimed in claim 5, **characterized in that** the u-link can be operated by means of a piston cylinder.

7. The hydraulic arrangement as claimed in any of claims 1 to 6, **characterized in that** the piston cylinders of the hydraulic cylinder assembly (14) are coupled in parallel with one another.

8. The hydraulic arrangement as claimed in any of claims 3 to 7, **characterized in that** each of the piston rods of the primary piston cylinders (15, 16) is provided with a first internal passage (18) to a compression chamber (19) in the respective piston cylinder (15, 16) and a second internal passage (20) to an expansion chamber (21) in the respective piston cylinder.

9. A heavy vehicle having a hydraulic arrangement for handling a load body (11) located on the vehicle, the load body being connected to the frame (12) of the vehicle by way of at least one articulated joint (13), enabling it to tip, and being designed to be moved between a lowered transport position and a raised tipping position, **characterized in that** the hydraulic arrangement comprises a hydraulic cylinder assembly (14), which with at least two piston cylinders (15-17), each working in its own

direction, which are hydraulically and mechanically coupled to one another.

10. The heavy vehicle as claimed in claim 9, **characterized in that** piston cylinders (15-17) of the hydraulic cylinder assembly (14) are arranged parallel and work in opposite directions.

CLAIMS

1. A hydraulic arrangement for operating a load body (11) on a truck, the load body being connected to the frame (12) of the vehicle by way of at least one articulated joint (13), enabling it to tip, and being designed to be moved between a lowered transport position and a raised tipping position, **characterized by** a hydraulic cylinder assembly (14), which comprises at least two parallel and in opposite direction working piston cylinders (15-17), which are hydraulically and mechanically coupled to one another.

2. The hydraulic arrangement as claimed in claim 1 or 2, **characterized in that** the hydraulic cylinder assembly (14) comprises three piston cylinders, of which two primary piston cylinders (15, 16) work in the same direction and a secondary piston cylinder (17) is located in the same plane between the said two piston cylinders (15, 16).

3. The hydraulic arrangement as claimed in claim 3, **characterized in that** the piston rods of the two primary piston cylinders (15, 16) are connected directly to the vehicle frame (12), and that the piston rod of the secondary piston cylinder (17) is connected to the load body (11).

4. The hydraulic arrangement as claimed in claim 4, **characterized in that** the piston rod of the secondary piston cylinder (17) is connected to the load body (11) by way of a mounting.

5. The hydraulic arrangement as claimed in claim 5, **characterized in that** the mounting () can be operated by means of a piston cylinder.

6. The hydraulic arrangement as claimed in any of claims 1 to 6, **characterized in that** the piston cylinders of the hydraulic cylinder assembly (14) are coupled in parallel with one another.

7. The hydraulic arrangement as claimed in any of claims 3 to 7, **characterized in that** each of the piston rods of the primary piston cylinders (15, 16) is provided with a first internal passage (18) to a compression chamber (19) in the respective piston cylinder (15, 16) and a second internal passage (20) to an expansion chamber (21) in the respective piston cylinder.

8. A truck having a hydraulic arrangement for handling a load body (11) located on the vehicle, the load body being connected to the frame (12) of the vehicle by way of at least one articulated joint (13), enabling it to tip, and being designed to be moved between a lowered transport position and a raised tipping position, **characterized in that** the hydraulic arrangement comprises a hydraulic cylinder assembly (14), which with at least two parallel and in opposite direction working piston cylinders (15-17), which are hydraulically and mechanically coupled to one another.

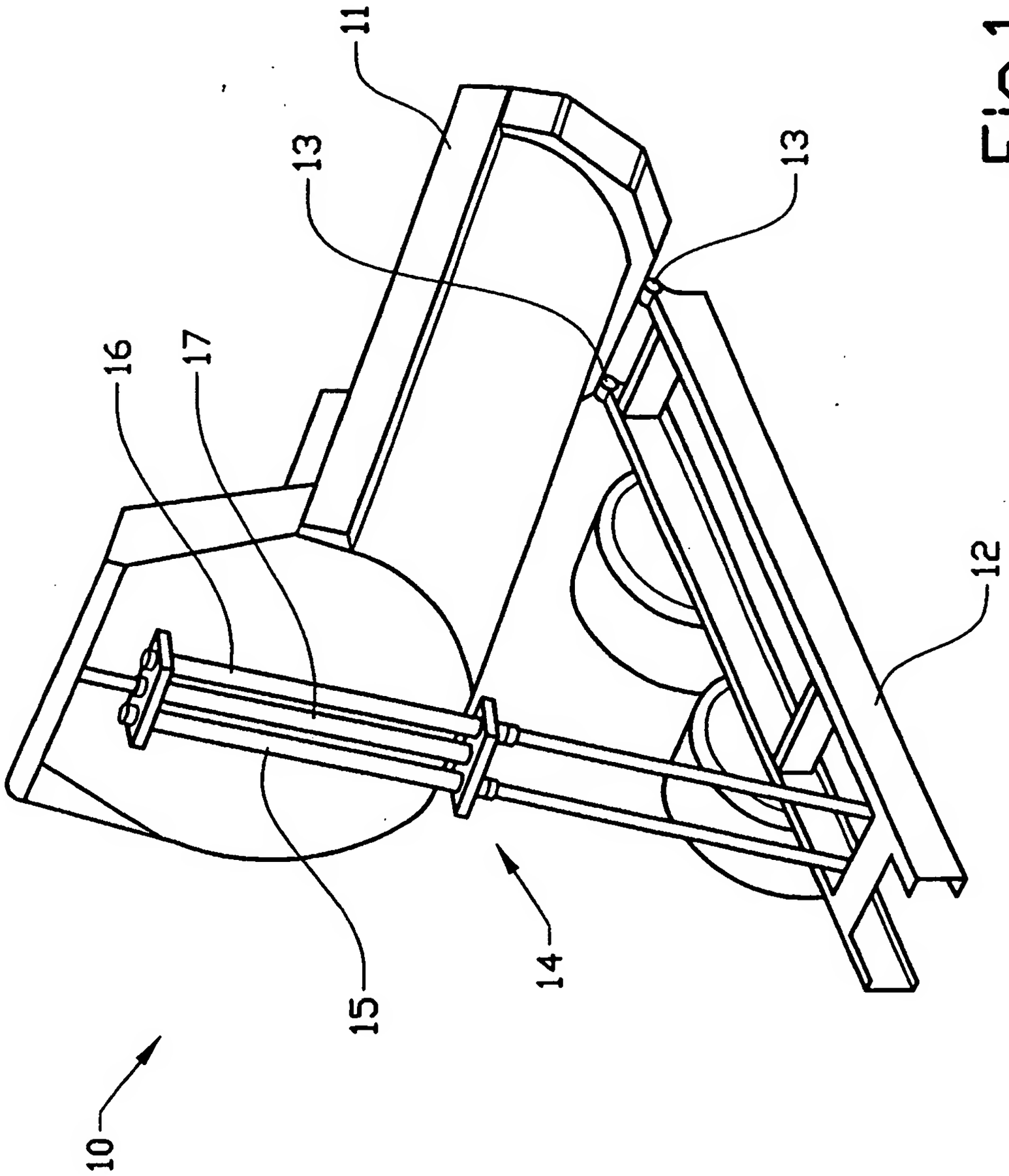
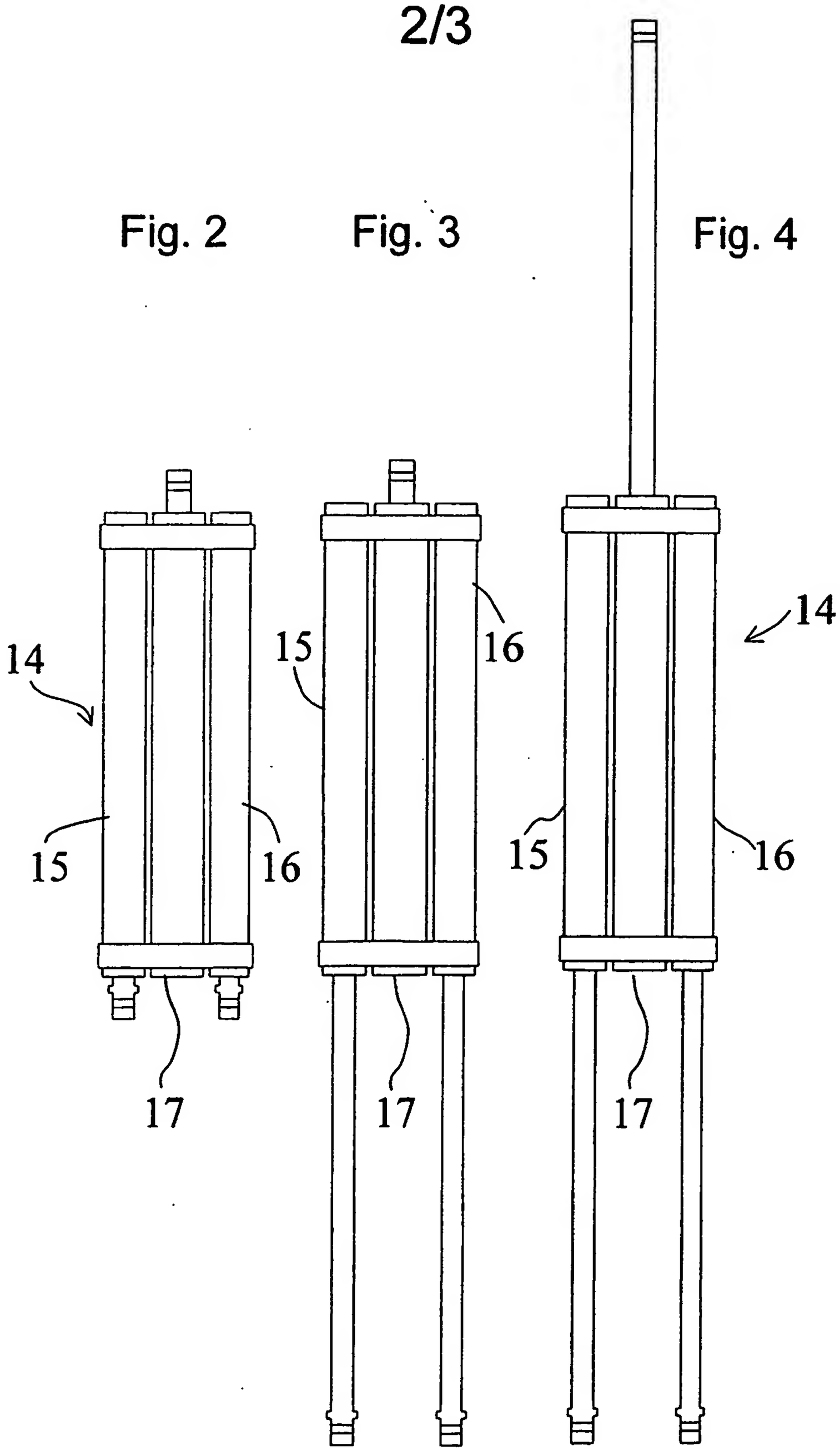



Fig.1

Fig. 2

Fig. 3

Fig. 4



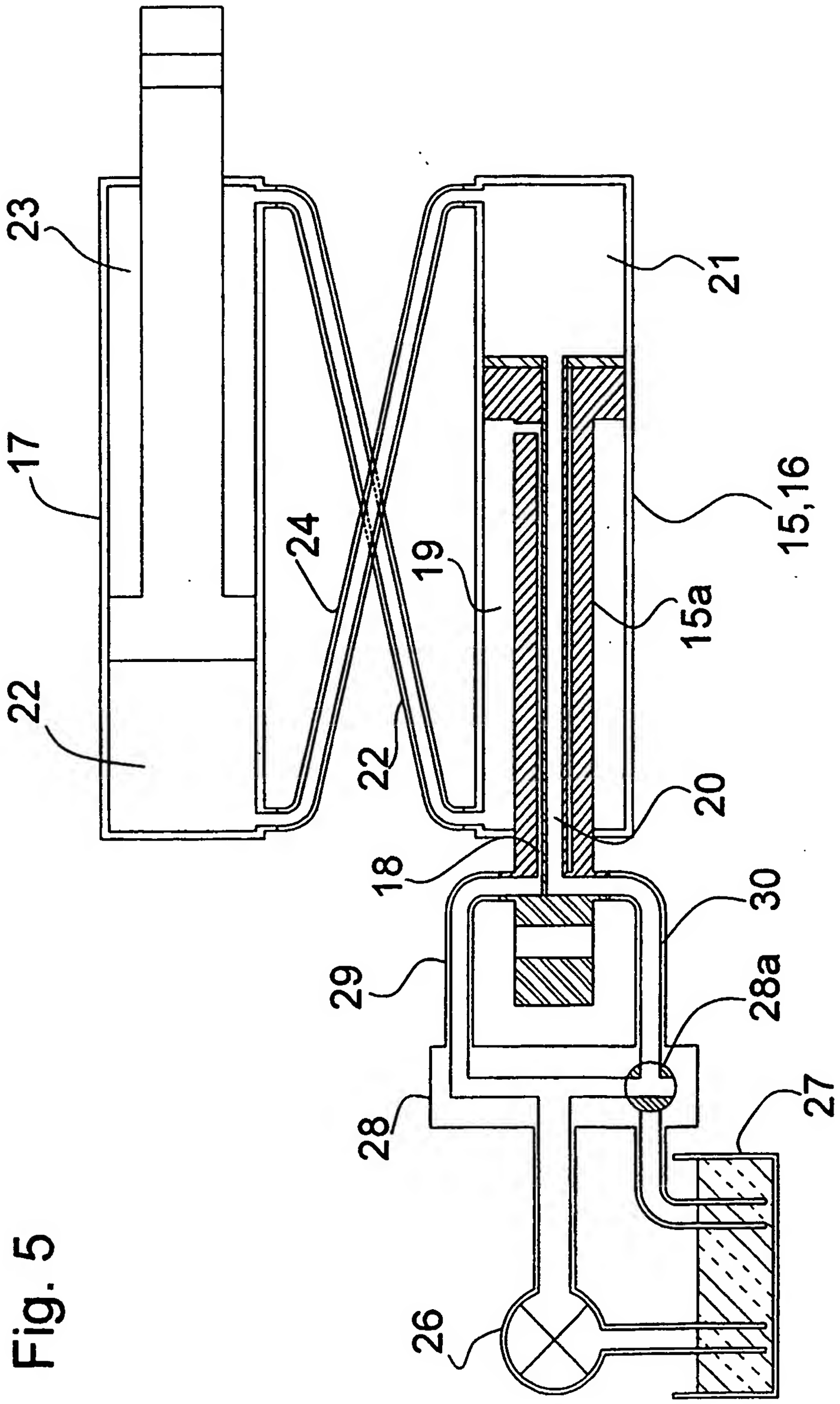



Fig. 5

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 02/00982

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B60P 1/16
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B60P

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO- INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | US 2476694 A (V.P. BOURNE-VANNECK), 19 July 1949 (19.07.49), column 3, line 15 - line 22; column 3, line 69 - column 4, line 15, figure 1 | 1,7,9 |
| Y | -- | 5,6 |
| X | FR 2645088 A1 (LERAY,JULES ET LERAY GERARD), 5 October 1990 (05.10.90), figure 1, abstract | 1 |
| | -- | |
| Y | CH 562711 A5 (ÅKE PERSSON), 13 June 1975 (13.06.75), column 1, line 61 - column 2, line 2 | 5,6 |
| | -- | |

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance
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| Date of the actual completion of the international search | Date of mailing of the international search report |
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| 30 August 2002 | 10 -09- 2002 |
| Name and mailing address of the ISA/<br>Swedish Patent Office<br>Box 5055, S-102 42 STOCKHOLM<br>Facsimile No. +46 8 666 02 86 | Authorized officer<br>Hans Nordström /js<br>Telephone No. +46 8 782 25 00 |

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 02/00982

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | DE 2424967 A1 (K.K. KOMATSU SEISAKUSHO), 7 May 1975 (07.05.75) -- | 8 |
| A | US 4488756 A (LEW DALMAN), 18 December 1984 (18.12.84) -- | 1,2,4,9,10 |
| A | US 2794673 A (H.C. HARBERS ET AL), 4 June 1957 (04.06.57) -- | 1,3,9 |

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

06/07/02

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PCT/SE 02/00982

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| US 2476694 A | 19/07/49 | NONE | |
| FR 2645088 A1 | 05/10/90 | NONE | |
| CH 562711 A5 | 13/06/75 | NONE | |
| DE 2424967 A1 | 07/05/75 | FR 2248955 A,B<br>US 3989301 A | 23/05/75<br>02/11/76 |
| US 4488756 A | 18/12/84 | NONE | |
| US 2794673 A | 04/06/57 | NONE | |